



## PATENT SPECIFICATION

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### PROVISIONAL SPECIFICATION.

#### Improvements relating to Electrically Operated Valves.

We, LEONARD MILLER, of 8, St. Anne's Road, Chorlton-cum-Hardy, Manchester, in the County of Lancaster, JAMES PHILIP CAMPBELL, of 120, Church Street, Barrow-in-Furness, in the County of Lancaster, FREDERICK BRERETON HOLT, of Greenfield Farm, Antrobus, near Northwich, in the County of Chester, all subjects of the King of Great Britain, and METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, of 4, Central Buildings, in the City of Westminster, a British company, do hereby declare the nature of this invention to be as follows:—

This invention relates to electrically operated valves and in particular to valves which are operated by a rotary electric motor and has for its object to provide an improved mechanism connecting the motor with the valve. A special feature of the mechanism is the means provided to produce a "hammer blow" necessary to unseat valves of this description.

According to the invention the operating motor is connected with the valve through a gear mechanism containing a mutilated gear so that at the start and finish of the opening or closing operation the motor will be actually disconnected from the operating shaft or spindle of the valve whereby the motor is enabled to start and attain a certain speed before the valve begins to open or close and also to continue running for a short space of time after the valve has reached its fully opened or closed position.

In one method of carrying out the invention which will be described by way of example, the motor is connected to the valve through a gear box attached or situated close to the valve and containing a worm on a main driving shaft which is coupled to the motor. The worm drives a worm wheel mounted in one half of the

gear box, which is preferably formed in two parts to facilitate assembly and easy construction. Attached to, and operated by, the worm wheel is a pinion which meshes with an internal spur wheel mounted on the rim of which is a second internal spur wheel having teeth only on one half of its circumference, the remaining half of the circumference being increased to a diameter slightly larger than that at the bottom of the spur teeth. The combined spur wheel runs freely on a suitable spindle mounted on the other half of the gear box. Adapted to mesh with the teeth of the mutilated spur gear is a pinion connected with a shaft driving the valve spindle through suitable gearing. The driving shaft is provided with a collar containing a recess in which a spring stop can engage, the stop being operated by means of a cam plate attached to the combined spur wheel.

The method of operation is as follows: When the valve is in the closed position the pinion on the driving shaft of the valve is arranged to be disengaged from the toothed portion of the mutilated gear. To open the valve the electric motor is started and through the worm, worm wheel and attached pinion drives the combined spur wheel at a greatly reduced speed. The teeth of the mutilated gear do not come into mesh with the pinion driving the valve shaft until it has moved through a certain angle which may be approximately ninety degrees, thus allowing the motor to accelerate to full speed and providing the "hammer blow" previously referred to. The pinion is then rotated through a suitable number of revolutions by the internal gear and the valve partially opened. The mutilated gear then disengages from the pinion and for approximately half a revolution runs idle until it again comes in contact with the pinion

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and this cycle continues until the valve is opened. This arrangement allows the motor to accelerate to full speed before commencing to open or close the valve and, after the motor is shut off, automatically allows for the "drift" or continued running of the motor for a short time thus preventing any damage to the valve. The collar on the driving shaft and the co-operating spring stop are provided to ensure that the driving pinion turns through an exact distance and does not, through inertia, overrun itself. This

is done by arranging that the cam plate attached to the combined spur wheel shall withdraw the spring stop from the recess in the collar on the driving shaft before the spur wheel engages with the pinion and to release it when the mutilated gear disengages from the pinion.

Dated the 15th day of June, 1922.

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### COMPLETE SPECIFICATION.

#### Improvements relating to Electrically Operated Valves.

We, LEONARD MILLER, of 8, St. Anne's Road, Chorlton-cum-Hardy, Manchester, in the County of Lancaster, JAMES PHILIP CAMPBELL, of 120, Church Street, Barrow-in-Furness, in the County of Lancaster, FREDERICK BRERETON HOLT, of Greenfield Farm, Antrobus, near Northwich, in the County of Chester, all subjects of the King of Great Britain, and METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, of 4, Central Buildings, in the City of Westminster, a British company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to apparatus for transmitting movement from an electric motor to a valve for the purpose of controlling the latter.

Apparatus of this kind has already been proposed but the design has been such that in operation the motor is connected with the valve during the whole of the travel of the latter and this may give rise to difficulty if for example the valve is partly opened and it is desired to open it further or to close it, and apparatus has been further proposed wherein provision is made whereby the motor is enabled to speed up at the commencement of an operation before it is connected with the valve and to continue running for a limited period after the valve has reached a limit of travel.

In accordance with the present invention provision is made for automatically effecting the intermittent connection and disconnection of the motor and the valve during an operation so that in addition to enabling the motor to speed up at the commencement of an operation and to continue running after the valve has reached a limit of travel, the motor and

valve will be intermittently connected and disconnected during the travel of the latter whereby a more flexible control is obtained and in the case where the valve is only partly opened a "hammer blow" can be imparted by which the inertia or seizure of the valve operating mechanism can be overcome and the valve opened further or closed with certainty.

In order that the invention may be more clearly understood and readily carried into practice reference will now be made to the accompanying drawings wherein a constructional form thereof is illustrated by way of example; Fig. 1 being a longitudinal vertical section on the line I—I of Fig. 2, and Fig. 2 an end elevation viewed in the direction of the arrow II, Fig. 1, with one half of the gear case removed.

In the form illustrated the apparatus comprises a gear case 3 formed in two parts 4 and 5 to facilitate construction and assembly, the part 5 being omitted from Fig. 2 of the drawings to simplify the illustration. Journalled in anti-friction bearings 6 supported by the part 4 is a spindle 7 carrying a worm 8 which engages a worm wheel 9 fast on a shaft 10 journalled in anti-friction bearings 11 also supported by the part 4 of the gear case. Keyed to one end of the shaft 10 is a pinion 12 engaging an internal spur wheel 13 secured to one side of a wheel 14 freely mounted upon a stub shaft 15 secured to the other part 5 of the gear case 3. Secured to the other side of the wheel 14 is an interrupted internal spur wheel 16 having teeth around half of its circumference only, the other half circumference being increased to a diameter slightly larger than that at the bottom of the spur teeth. The wheel 16 carries a cam plate 17 the function of which will be hereinafter described, both wheels 13

and 16 and the cam plate 17 being secured to the wheel 14 by bolts 18. Journalled in the end wall of the part 5 of the gear case 3 is a shaft 19 carrying a pinion 20 and a collar 21 having a notch 22 therein. The pinion 20 is adapted to engage the teeth of the interrupted spur wheel 16 and a trigger 23 pivoted to the part 5 is adapted to engage the notch 22 said trigger having a tail piece 24 which is pressed into contact with the cam plate 17 by a spring 25.

The spindle 7 is coupled with an electric motor and the shaft 19 with the valve to be controlled, the arrangement being such that when the valve is closed the pinion 20 is out of engagement with the interrupted gear 16. To open the valve the electric motor is started and through the worm 8, worm wheel 9, pinion 12 and gear wheel 13 drives the interrupted gear wheel 16 at a greatly reduced speed. The teeth of the gear wheel 16 do not engage the pinion 20 until the gear wheel has moved through a certain angle, which may conveniently be approximately ninety degrees as shown on the drawing, thus allowing the motor to accelerate to full speed and impart the "hammer blow" previously referred to. The pinion 20 is then rotated through a number of revolutions by engagement with the toothed portion of the gear 16 and the valve partially opened. The interrupted gear 16 then disengages from the pinion 20 and for approximately half a revolution runs idle and this cycle is repeated until the valve is opened to the desired extent. For closing the valve the cycle of operations is similar but the motor is of course run in the opposite direction.

This arrangement allows the motor to accelerate to full speed before commencing to open or close the valve, admits of the motor speeding up at intervals during its operation, and, after the motor is shut off, automatically allows for the "drift" or continued running of the motor for a short time, thus preventing damage to the valve. The notched collar 21 and co-operating trigger 23 are provided to ensure that the pinion 20 turns through an exact distance and does not, through inertia, overrun itself. This is effected by arranging that the cam plate 17 shall withdraw the trigger 23 from the notch 22 before the gear 16 engages the pinion 20 and release it when or before the gear 16 disengages from the pinion 20.

Although one constructional form has been illustrated by way of example the invention is in no way limited to this form but may be modified as desired within the limits defined by the succeeding claims.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Apparatus for transmitting movement from an electric motor to a valve wherein provision is made for automatically effecting the intermittent connection and disconnection of the motor and the valve during the travel of the latter, for the purpose set forth.

2. Apparatus as claimed in Claim 1, comprising a gear train including an interrupted gear.

3. Apparatus for transmitting movement from an electric motor to a valve for the purpose of controlling the latter, comprising an interrupted gear wheel adapted to be continuously rotated by the electric motor and a complete gear wheel adapted to engage said interrupted gear wheel and to be connected with the valve.

4. Apparatus as claimed in Claim 1, 2 or 3, provided with means for ensuring that the valve will be moved a predetermined distance each time it is connected with the motor.

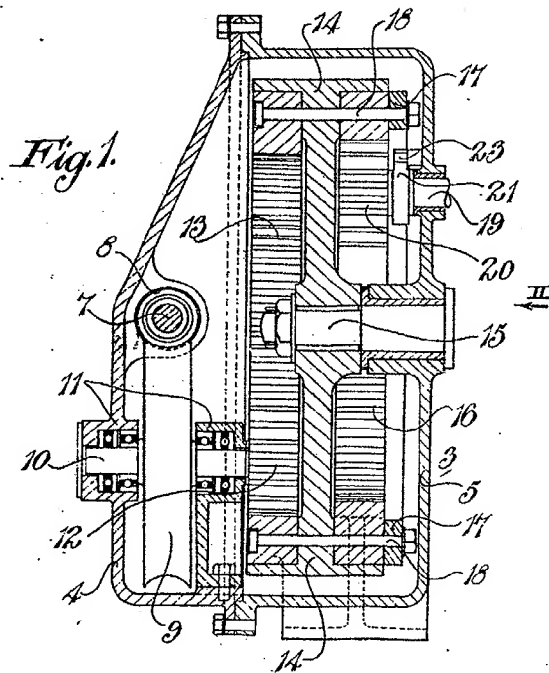
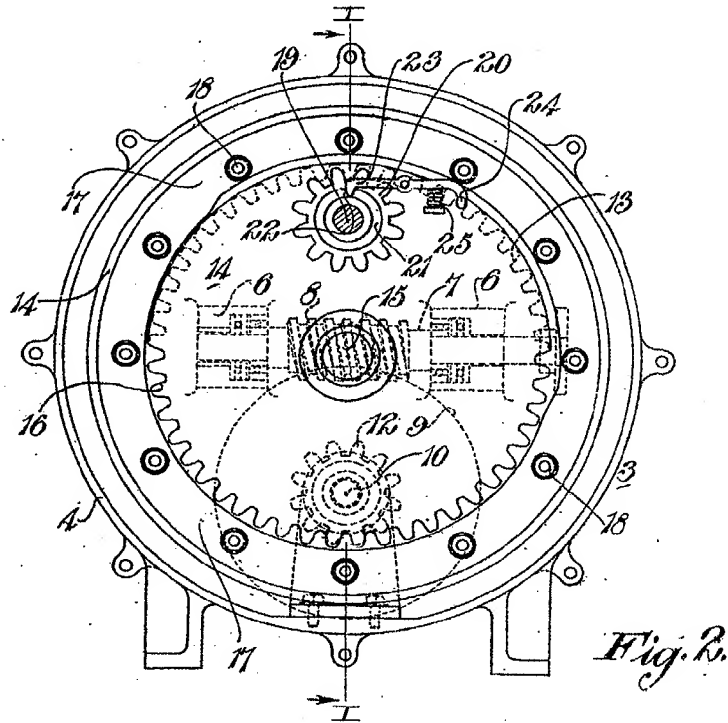
5. Apparatus as claimed in Claims 3 and 4, wherein the means for ensuring that the valve will be moved a predetermined distance each time it is connected with the motor comprises a trigger or detent adapted to engage a notch or equivalent in the complete gear wheel or in some part connected therewith and a cam or equivalent connected with the interrupted gear wheel adapted to move said trigger or detent out of engagement with said notch or equivalent.

6. Apparatus for transmitting movement from an electric motor to a valve for the purpose of controlling the latter constructed substantially as described with reference to the accompanying drawings.

Dated the 7th day of March, 1923.

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[This Drawing is a reproduction of the Original on a reduced scale.]



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